REMARKS

Claims 1, 4, 5, 10-12, 14-16, 19 and 20 are all the claims pending in the application.

Reconsideration and review of the claims on the merits are respectfully requested.

Claim Rejections – 35 U.S.C. § 103

Claims 1 and 5 are rejected under 35 U.S.C. § 103(a) as assertedly being unpatentable over Terashima et al (U.S. Patent 6,069,021) for the reasons given in the Office Action. This is a new rejection from the previous rejections.

With regard to claim 1: The Examiner asserts that Terashima et al teaches a group-III nitride semiconductor light-emitting device comprising a single crystal substrate having thereon a light-emitting part structure comprising a gallium nitride single crystal layer provided via a boron phosphide (BP) based buffer layer, wherein the boron phosphide based buffer layer comprises a multi-layer structure including an amorphous layer and a crystalline layer formed on the amorphous layer, both the amorphous and crystalline layer being made of boron phosphide (BP), and the gallium nitride single crystal layer being in contact with the crystalline layer of boron phosphide.

The Examiner recognizes that Terashima et al does not necessarily teach, instead of the gallium nitride single crystal layer, a gallium nitride phosphide single crystal layer of composition $GaN_{0.97}P_{0.03}$. However, the Examiner asserts that Terashima et al does teach the reduction of the mismatch between the lattice parameters of the buffer layer and the GaN layer by introducing 3% nitrogen into the BP buffer layer. The Examiner states that given the well-known role of phosphorous to increase the lattice parameters of both GaN and BN and the linear

relationship between the lattice parameter and the composition ratio of nitrogen versus phosphorous, it is believed to be obvious to the Examiner that one could also reduce lattice mismatch between the GaN and BP layers by introducing phosphorous into GaN.

With regard to claim 5: The Examiner asserts that the device taught by Terashima et al comprises a double hetero-junction structure as a light-emitting part structure.

Previous rejections of Claims 1, 4-5, 10-12 and 14-15 have been maintained by the Examiner. The Examiner adds the new rejection, discussed above, of Claim 1 over Terashima et al as an alternate basis for each of the following rejections. Otherwise, the reasons for the rejections are the same as previously stated in the Office Action, dated November 14, 2002, at paragraphs 2-7. For purposes of brevity, the Examiner's comments are not restated here.

Claims 1 and 5 have been rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Hatano et al (U.S. Patent 5,042,043), in view of Kawai (JP4110455892A) and Terashima et al.

Claim 4 has been rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Hatano et al, Kawai and Terashima et al as applied to claim 1 above, or, in the alternative, over Terashima et al as applied to claim 1 above, and further in view of Liu et al (U.S. Patent 5,612,551).

Claim 10 has been rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Hatano et al, Kawai and Terashima et al, or, in the alternative: over Terashima et al, both as applied to claim 1 above, and further in view of Doll (U.S. Patent 5,326,424).

Claim 11 has been rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Hatano et al, Kawai, Terashima et al and Liu et al, or, in the alternative, over Terashima et al and Liu et al, both as applied to claim 4 above, and further in view of Doll et al.

Claim 12 has been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Hatano et al, Kawai, and Terashima et al, or, in the alternative, over Terashima et al, both as applied to claim 5, respectively, above, and further in view of Doll et al.

Claims 14 and 15 have been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Hatano et al, Kawai and Terashima et al, or, in the alternative, over Terashima et al, both as applied to claim 1 above, and further in view of Isokawa et al (U.S. Patent 6,121,637).

Applicant respectfully traverses.

Terashima et al discloses a light-emitting device, including light-emitting layer 105 made of $Ga_{0.08}In_{0.12}N$ provided via lower cladding layer 104 made of n-type GaN doped with Si on a buffer layer including crystalline layer 103 made of BP and amorphous (polycrystalline) layer also made of BP. Thus, a substantial difference between Terashima et al and the present invention is that the single crystal layer in contact with the crystalline BP buffer layer contains a small amount of P, whereas lower cladding layer 104 of Terashima et al does not. The Examiner considered the invention to be obvious in view of Terashima et al which teaches introducing nitrogen into the upper buffer layer for the same purpose, namely, to achieve better lattice matching. The Examiner mistakenly considered this to be a case of the ranges of the claimed composition overlapping prior art ranges.

First, Terashima et al does not disclose a GaNP single crystal layer formed in contact with upper buffer layer 103. In fact, there is nothing in Terashima et al which teaches or suggests adding P to lower cladding layer 104. Therefore, this cannot be the case of overlapping ranges, because Terashima et al is utterly silent with respect to adding P to lower cladding layer 104.

Secondly, even in Tersahima et al teaches the introduction of N into the upper buffer layer to promote lattice matching, this is not a disclosure of adding P to the lower cladding layer. Particularly, in order to support the rejection the Examiner must point to something in the prior art which teaches the desirability, and hence the obviousness, of incorporating P into the lower cladding layer. There is no such suggestion or motivation for modifying the prior art in this manner.

In addition, Applicant's invention of adding P to the GaN single crystal layer in contact with the upper buffer layer has further merit. As seen in page 20, lines 28-32 of the present specification, the degree of lattice mismatch between the lower clad layer comprising $GaN_{0.97}P_{0.03}$ single crystal and the light-emitting layer comprising cubic $Ga_{0.94}In_{0.06}N$ becomes 0 when the light-emitting layer is made of cubic $Ga_{0.94}In_{0.06}N$. As a result, as seen in page 21, lines 7-8 of the present specification, a light-emitting layer having reduced crystal defects attributable to the lattice mismatch can be formed.

To emphasize this point, claim 1 has been amended to recite that, "the gallium nitride phosphide single crystal layer consisting of $GaN_{0.97}P_{0.03}$ is formed in contact with the crystalline

layer of boron phosphide, and a light-emitting layer made of cubic $Ga_{0.94}In_{0.06}N$ is formed on said gallium nitride phosphide single crystal layer consisting of $GaN_{0.97}P_{0.03}$.

Both lattice mismatches between the crystalline layer of boron phosphide and the lower clad layer made of $Gan_{0.97}P_{0.03}$ and between the lower clad layer and the light-emitting layer made of cubic $Ga_{0.94}In_{0.06}N$ become 0 in Applicant's invention of amended Claim 1. This is because the gallium nitride phosphide single crystal layer (lower clad layer) is made of $GaN_{0.97}P_{0.03}$, a feature neither disclosed nor suggested by Terashima et al.

Applicant submits that the invention is also not obvious over Hatano et al in view of Kawai and Terashima for the same reasons mentioned above. In addition, the amendment to claim 1 to recite that the gallium nitride phosphide single crystal layer amended consists of $GaN_{0.97}P_{0.03}$ further defines over Hatano et al. Additionally, although Hatano et al discloses a lower clad GaAlN/BP layer in contact with a BP buffer layer, Hatano et al fails to disclose the claimed buffer layer structure of the invention including a crystalline layer disposed on an amorphous layer.

Accordingly, for the reasons given above, Applicant kindly requests reconsideration and withdrawal of the rejections under 35 U.S.C. § 103(a).

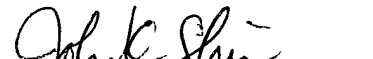
Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the

Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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Date: July 22, 2003

APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

The claims are amended as follows:

1. (Three Times Amended) A group-III nitride semiconductor light-emitting device comprising a single crystal substrate having thereon a light-emitting part structure comprising a gallium nitride phosphide ($GaN_{1-x}P_x$, wherein $0<X<1$) single crystal layer provided via a boron phosphide (BP)-based buffer layer, wherein

the boron phosphide-based buffer layer comprises a multilayer structure including an amorphous layer and a crystalline layer formed on the amorphous layer,

both the amorphous layer and the crystalline layer being made of boron phosphide (BP), [and]

the gallium nitride phosphide single crystal layer ~~being made~~ consisting of $GaN_{0.97}P_{0.03}$ is formed in contact with the crystalline layer of boron phosphide, and

a light-emitting layer made of cubic $Ga_{0.94}In_{0.06}N$ is formed on said gallium nitride phosphide single crystal layer consisting of $GaN_{0.97}P_{0.03}$.